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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,283	02/18/2004	Ryuichi Ugajin	09792909-5796	2062

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EXAMINER
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WILSON, SCOTT R

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 12/17/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

At

<b>Office Action Summary</b>	<b>Application No.</b> 10/781,283	<b>Applicant(s)</b> UGAJIN, RYUICHI	
	<b>Examiner</b> Scott R. Wilson	<b>Art Unit</b> 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 June 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 6-22 is/are rejected.
- 7) ☒ Claim(s) 4 and 5 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 10 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The language "a density of the electron system" implies that there are several distinct densities. There is no support for several distinct densities in the specification.

Claims 12 and 22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The language "a transfer between the first region and the second region is equal to or less than a transfer of the first region and a transfer of the second region" is indefinite, even in light of paragraph [0042], on page 10, of the specification, since it is not clear what is transferred.

Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The language "which is provided with the second region and the first regions disposed on each sides of the second region" is indefinite. It is not clear how the second region can be disposed on the side of itself.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 6-11, 13-15 and 17-19 are rejected under 35 U.S.C. 102(b) as being anticipated by Yokoyama. As to claim 1, Yokoyama, Figure 1, and the Abstract, discloses an electron device which controls quantum chaos comprising: a heterojunction which is provided with a first region (4) having an electron system characterized by quantum chaos and a second region (6) having an electron system characterized by integrability, the first region and the second region being adjacent to each other, and the heterojunction being capable of exchanging electrons between the first region and the second region, wherein a quantum chaos property of an electron system in a system formed of the first region and the second region is controlled by applying to the heterojunction an electric field, embodied as applying a voltage to electrode (12), having a component perpendicular to at least a junction surface.

As to claim 2, Yokoyama, Figure 1, discloses that the electron device further comprises an electrode (12) for applying the electric field to the heterojunction.

As to claim 3, Yokoyama, Abstract, discloses the first region (4) to be in a metallic state, and the second region (6) to have a random medium, embodied as a doping impurity.

As to claim 6, Yokoyama discloses (page 3, left-hand column, upper half) that the thickness of, for example, the tunnel layer (5) is 500 Å, or 0.050 μm, which would mean that, measuring from Figure 1, the total length of the heterojunction, between layers (5) and (6), for example is a few tenths of a micron. The electron coherence length in a similar AlGaAs/GaAs heterojunction device is about 1 micron to 5 microns. (see de Alamo et al., col. 1, line 20)

As to claim 7, Yokoyama, Figure 1, discloses that each of the first region (4) and second region (6) has the shape of a layer.

As to claim 8, Yokoyama, Figure 1, and the Abstract, discloses that the electrode (12) for applying electric field to the heterojunction is formed, via an insulating film (7), on at least one of the first region and the second region each having the layer shape.

As to claim 9, Yokoyama, Figure 1, and the Abstract, discloses the quantum chaos property of the electron system of the system formed of the first region and the second region is controlled by setting a Fermi level of the electron system to a predetermined value, embodied as doping first region (4) and second region (6) to be n-type, in addition to the application of electric field.

Art Unit: 2826

As to claim 10, Yokoyama, Figure 1, and the Abstract, discloses that the Fermi level is set to the predetermined value by controlling a density of the electron system, embodied as doping first region (4) and second region (6) to be n-type.

As to claim 11, Yokoyama discloses that the critical electric field intensity with which a transition from quantum chaos to an integrable system occurs is controlled by the control on the Fermi level.

As to claim 13, Yokoyama, Figure 1, and the Abstract, discloses a tunnel barrier (5) region formed between the first region (4) and the second region (6).

As to claim 14, Yokoyama, Figure 1, and the Abstract, discloses that each of the first region (4) and the second region (6) is formed from a semiconductor and the tunnel barrier region (5) is formed from a semiconductor of which energy at a bottom of a conductive band is higher than that of the semiconductor used for forming the first region and the second region.

As to claim 15, Yokoyama, Figure 1, and the Abstract, discloses that each of the first region (4) and the second region (6) is formed from GaAs and the tunnel barrier region (5) is formed from AlGaAs.

As to claim 17, Yokoyama, Figure 1, and the Abstract, discloses a tunnel barrier (5) region formed between the first region (4) and the second region (6).

As to claim 18, Yokoyama, Figure 1, and the Abstract, discloses that each of the first region (4) and the second region (6) is formed from a semiconductor and the tunnel barrier region (5) is formed from a semiconductor of which energy at a bottom of a conductive band is higher than that of the semiconductor used for forming the first region and the second region.

As to claim 19, Yokoyama, Figure 1, and the Abstract, discloses that each of the first region (4) and the second region (6) is formed from GaAs and the tunnel barrier region (5) is formed from AlGaAs.

Claims 20 and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Yokoyama. Yokoyama, Figure 1 and the Abstract, discloses a quantum chaos control method comprising: using a heterojunction which is provided with a first region (4) having an electron system characterized by quantum chaos and second region (6) having an electron system characterized by integrability, the first region and the second region being adjacent to each other, and the heterojunction being capable of exchanging electrons between the first region and the second region, and controlling a quantum chaos

Art Unit: 2826

property of an electron system in a system formed of the first region and the second region by applying to the heterojunction an electric field, embodied as applying a voltage to electrode (12), having a component perpendicular to at least a junction surface.

As to claim 21, Yokoyama, Figure 1, and the Abstract, discloses the quantum chaos property of the electron system of the system formed of the first region and the second region is controlled by setting a Fermi level of the electron system to a predetermined value, embodied as doping first region (4) and second region (6) to be n-type, in addition to the application of electric field.

***Allowable Subject Matter***

Claims 4 and 5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. No prior art discloses the claimed device with a magnetic impurity, such as Mn, as described in the specification, added to the second region.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Scott R. Wilson whose telephone number is 571-272-1925. The examiner can normally be reached on M-F 8:30 - 4:30 Eastern.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

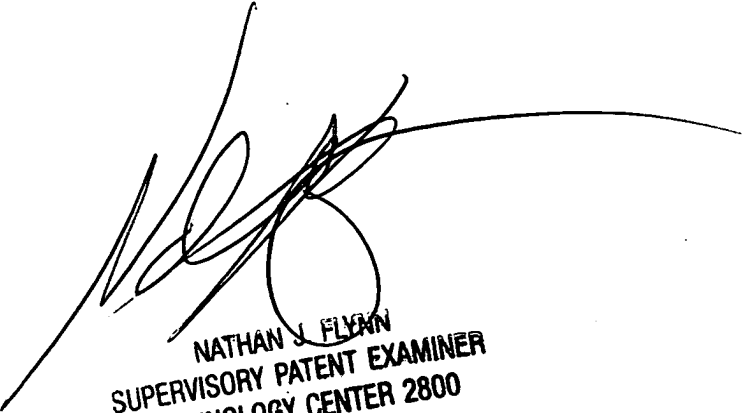
Application/Control Number: 10/781,283

Page 6

Art Unit: 2826

srw

December 8, 2004



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